

Amendments to the Claims:

The listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Twice Amended) A non-contact rotational position sensor comprising:
a permanent magnet having a circular or arc-shaped outer circumference;
a shaft for supporting and fixing said permanent magnet;
upper and lower magnetic plates sandwiching said permanent magnet from above and below, at least one of said upper and lower magnetic plates being horizontally separated from each other with an air gap formed therebetween;
[at least one protruded magnetic substance portion disposed between said upper and lower magnetic plates]; and
a magnetic sensitive device disposed on a protruded surface of [said] a protruded magnetic substance portion,
said permanent magnet and said shaft constituting a rotor which is rotatable relative to said upper and lower magnetic plates vertically spaced from each other,
said permanent [magnetic] magnet being magnetized substantially in the direction of a rotating axis, whereby the amount of magnetic flux passing said magnetic sensitive device is varied with rotation of said permanent magnet,
wherein said upper and lower magnetic plates sandwiching said permanent magnet from above and below are [formed of] magnetic plates each having protruded portions at opposite ends [instead of providing said protruded magnetic substance portion on at least one of said upper and lower magnetic plates], said protruded portions being bent to [form pairs

of] comprise upper and lower [protruded portions] pairs, and said magnetic sensitive device is [inserted] arranged in an air gap formed between [protruded] surfaces of every two of said upper and lower pairs of protruded portions[:] ;

said upper magnetic plate is comprised of a first upper magnetic plate and a second upper magnetic plate; said lower magnetic plate is comprised of a first lower magnetic plate and a second lower magnetic plate; said permanent magnet consists of two permanent magnets, in which the first of the permanent magnets is magnetized in one direction, and the second of the permanent magnets is magnetized in a direction opposite to the one direction; a first area in which the magnetic field of the first permanent magnet has the one direction and a first area in which magnetic field of the second permanent magnet has the opposite direction being positioned between said first upper magnetic plate and said first lower magnetic plate; and a second area in which the magnetic field of the first permanent magnet has the one direction and a second area in which the magnetic field of the second permanent magnet has the opposite direction being positioned between said second upper magnetic plate and said second lower magnetic plate;

whereby the first upper magnetic plate and the first lower magnetic plate thus form a linear magnetic circuit between the permanent magnet and the protruded magnetic substance portion independent of a rotating position of said permanent magnet, and the second upper magnetic plate and said second lower magnetic plate thus form a linear magnetic circuit between said permanent magnet and the protruded magnetic substance portion independent of the rotating position of the permanent magnet.

2. (Amended) A non-contact rotational position sensor comprising:
a rotating axis;

an annular or semi-annular magnet fixed to said rotating axis;

magnetic substance assemblies arranged in opposing relation to sandwich said magnet therebetween with a spacing greater than a thickness of said magnet left between said magnetic substance assemblies in [the] an axial direction of said rotating axis, such that a uniform air gap is formed between said magnet and a surface of each of said magnetic substance assemblies [confronting] facing said magnet;

a pair of small air gaps [formed in] defined by said magnetic substance assemblies and being smaller than said uniform air gap; and

a magnetic sensitive device disposed in each said small air gap,

wherein said magnetic substance assemblies comprise a pair of rectangularly-shaped magnetic plates, and at least one of said pair of rectangular magnetic plates [has a split] is divided by a separating air gap [formed along an imaginary plane] passing [an axial center line of] through said rotating axis[, said air gap splitting said rectangular magnetic plate into two parts]; the at least one pair of magnetic plates comprising upper and lower magnetic plates in which the upper magnetic plate is comprised of a first upper magnetic plate and a second upper magnetic plate, the lower magnetic plate is comprised of a first lower magnetic plate and a second lower magnetic plate, the magnet is comprised of two magnets with the first of the being magnetized in one direction, and the second of the magnets being magnetized in a direction opposite to the one direction; a first area in which a magnetic field of the first magnet has the one direction and a first area in which a magnetic field of the second magnet has the opposite direction being positioned between first upper magnetic plate and the first lower magnetic plate; and a second area in which the magnetic field of the first magnet has the one direction and a second area in which the magnetic field of the second magnet has the opposite direction being positioned between second upper magnetic plate and the second lower

magnetic plate; whereby the first upper magnetic plate and the first lower magnetic plate thus form a linear magnetic circuit between the magnet and the protruded magnetic substance portion independent of the rotational position of the magnet, and the second upper magnetic plate and the second lower magnetic plate thus form a linear magnetic circuit between said magnet and a protruded magnetic substance portion independent of the rotational position of the magnet.

3. (Amended) A non-contact rotational position sensor comprising:

a rotating axis;

an annular or semi-annular magnet fixed to said rotating axis;

magnetic substance assemblies arranged in opposing relation to sandwich said magnet therebetween with a spacing greater than a thickness of said magnet [left] arranged between said magnetic substance assemblies in [the] an axial direction of said rotating axis, such that a uniform air gap is formed between said magnet and a surface of each of said magnetic substance assemblies [confronting] facing said magnet;

a pair of small air gaps [formed in] defined by said magnetic substance assemblies and being smaller than said uniform air gap; and

a magnetic sensitive device disposed in each said small air gap,

wherein said pair of small air gaps are formed in symmetrical positions with respect to said rotating axis situated therebetween, the at least one pair of magnetic plates comprising upper and lower magnetic plates in which the upper magnetic plate is comprised of a first upper magnetic plate and a second upper magnetic plate, the lower magnetic plate is comprised of a first lower magnetic plate and a second lower magnetic plate, the magnet is comprised of two magnets with the first of the being magnetized in one direction, and the second of the magnets being magnetized in a direction opposite to the one direction; a first area in which a magnetic

field of the first magnet has the one direction and a first area in which a magnetic field of the second magnet has the opposite direction being positioned between first upper magnetic plate and the first lower magnetic plate; and a second area in which the magnetic field of the first magnet has the one direction and a second area in which the magnetic field of the second magnet has the opposite direction being positioned between second upper magnetic plate and the second lower magnetic plate; whereby the first upper magnetic plate and the first lower magnetic plate thus form a linear magnetic circuit between the magnet and the protruded magnetic substance portion independent of the rotational position of the magnet, and the second upper magnetic plate and the second lower magnetic plate thus form a linear magnetic circuit between said magnet and a protruded magnetic substance portion independent of the rotational position of the magnet.

4. (Amended) A non-contact rotational position sensor according to claim 3, wherein said pair of small air gaps are each formed between confronting surfaces of a pair of protrusions protruded from said magnetic [plate] substance assemblies in directions in which said protrusions come closer to each other.

5. (Twice Amended) A throttle valve assembly comprising:
an annular or semi-annular magnet attached to one end of a throttle valve;
a resin cover attached to a body in which said throttle valve is mounted;
an auxiliary ~~cover~~ cover attached to said resin cover;
magnetic path forming members attached to said resin cover and said auxiliary cover, respectively, and forming magnetic paths with said annular or semi-annular magnet situated therebetween;

a magnetic flux converging portion formed in each of said magnetic paths and concentrating a magnetic flux passing said magnetic path to a [particular] predetermined position; and

a magnetic sensitive device attached to said magnetic flux converging portion and detecting change of the magnetic flux in said magnetic flux converging portion caused upon rotation of said throttle valve, the magnetic path members comprising upper and lower magnetic plates in which the upper magnetic plate is comprised of a first upper magnetic plate and a second upper magnetic plate, the lower magnetic plate is comprised of a first lower magnetic plate and a second lower magnetic plate, the magnet is comprised of two magnets with the first of the being magnetized in one direction, and the second of the magnets being magnetized in a direction opposite to the one direction; a first area in which a magnetic field of the first magnet has the one direction and a first area in which a magnetic field of the second magnet has the opposite direction being positioned between first upper magnetic plate and the first lower magnetic plate; and a second area in which the magnetic field of the first magnet has the one direction and a second area in which the magnetic field of the second magnet has the opposite direction being positioned between second upper magnetic plate and the second lower magnetic plate; whereby the first upper magnetic plate and the first lower magnetic plate thus form a linear magnetic circuit between the magnet and the protruded magnetic substance portion independent of the rotational position of the magnet, and the second upper magnetic plate and the second lower magnetic plate form a linear magnetic circuit between said magnet and a protruded magnetic substance portion independent of the rotational position of the magnet.

6. (Original) A throttle valve assembly according to claim 5, further comprising:

a motor for driving said throttle valve; and

a magnetic substance arranged between said motor and said magnetic paths.

7. (Original) A throttle valve assembly according to claim 6, wherein said magnetic substance is in the form of a gear for transmitting rotation of said motor to a rotating shaft of said throttle valve, or in the form of a rotating shaft of said gear.

8. (Original) A throttle valve assembly according to claim 5, wherein said resin cover has a hole for insertion of a rotating shaft provided with said throttle valve fitted thereon;

said magnetic path forming member attached to the side of said resin cover has a hole formed at the center thereof and having a diameter greater than a diameter of said rotating shaft, but smaller than a diameter of said annular or semi-annular magnet; and

said annular or semi-annular magnet is detachably attached to an end of said rotating shaft inserted through said hole in said magnetic path forming member.

9. (Amended) A non-contact rotational position sensor comprising:
two permanent magnets having a circular or arc-shaped outer circumference;
a shaft for supporting and fixing said permanent magnet;
upper and lower magnetic plates sandwiching said permanent magnet from above and below, at least one of said upper and lower magnetic plates being horizontally separated from each other with an air gap formed therebetween;
at least one protruded magnetic substance portion disposed between said upper and lower magnetic plates; and

a magnetic sensitive device disposed on a protruded surface of said protruded magnetic substance portion,

said permanent magnet and said shaft constituting a rotor which is rotatable relative to said upper and lower magnetic plates vertically spaced from each other,

said permanent magnet being magnetized substantially in the direction of a rotating axis, whereby the amount of magnetic flux passing said magnetic sensitive device is varied with rotation of said permanent magnet, said upper magnetic plate is comprised of a first upper magnetic plate and a second upper magnetic plate; said lower magnetic plate is comprised of a first lower magnetic plate and a second lower magnetic plate; the first of the permanent magnets being magnetized in one direction and the second of the permanent magnets being magnetized in a direction opposite to the one direction; a first area in which a magnetic field of the first permanent magnet has the one direction and a first area in which a magnetic field of the second permanent magnet has the opposite direction being positioned between said first upper magnetic plate and said first lower magnetic plate; and a second area in which the magnetic field of the first permanent magnet has the one direction and a second area in which the magnetic field of the second permanent magnet has the opposite direction being positioned between said second upper magnetic plate and said second lower magnetic plate; whereby the first upper magnetic plate and the first lower magnetic plate thus form a linear magnetic circuit between the permanent magnet and the protruded magnetic substance portion independent of a rotating position of said permanent magnet, and the second upper magnetic plate and said second lower magnetic plate thus form a linear magnetic circuit between said permanent magnet and the protruded magnetic substance portion independent of the rotating position of the permanent magnet

10. (New) A non-contact rotational position sensor according to Claim 9, wherein said permanent magnet is in the form of a ring.

11. (New) A non-contact rotational position sensor according to Claim 9, wherein said permanent magnet is in the form of an arc having a certain width in the radial direction.

12. (New) A non-contact rotational position sensor according to Claim 9, wherein said permanent magnet is in the form of a disk.

13. (Amended) A non-contact rotational position sensor according to Claim 9, wherein each of air gaps between said permanent magnet and said upper and lower magnetic plates has a width of not less than 0.5 mm.

14. (Amended) A non-contact rotational position sensor comprising:
a permanent magnet having a circular or arc-shaped outer circumference;
a shaft for supporting and fixing said permanent magnet;
magnetic plates sandwiching said permanent magnet from opposite outer sides in the radial direction;

a magnetic circuit having a portion for converging a magnetic flux generated from said permanent magnet;

an air gap formed at a fore end of the magnetic flux converging portion of said magnetic circuit; and

a magnetic sensitive device disposed in said air gap,

said permanent magnet and said shaft constituting a rotor which is rotatable relative to said magnetic plates arranged outwardly of said permanent magnet in the radial direction, said permanent magnet being magnetized substantially in the radial direction, whereby the amount of magnetic flux passing said magnetic sensitive device is varied with rotation of said permanent magnet the at least one pair of magnetic plates comprising upper and lower magnetic plates in which the upper magnetic plate is comprised of a first upper magnetic plate and a second upper magnetic plate, the lower magnetic plate is comprised of a first lower magnetic plate and a second lower magnetic plate, the magnet is comprised of two magnets with the first of the being magnetized in one direction and the second of the magnets being magnetized in a direction opposite to the one direction; a first area in which a magnetic field of the first magnet has the one direction and a first area in which a magnetic field of the second magnet has the opposite direction being positioned between first upper magnetic plate and the first lower magnetic plate; and a second area in which the magnetic field of the first magnet has the one direction and a second area in which the magnetic field of the second magnet has the opposite direction being positioned between second upper magnetic plate and the second lower magnetic plate; whereby the first upper magnetic plate and the first lower magnetic plate thus form a linear magnetic circuit between the magnet and the protruded magnetic substance portion independent of the rotational position of the magnet, and the second upper magnetic plate and the second lower magnetic plate thus form a linear magnetic circuit between said magnet and a protruded magnetic substance portion independent of the rotational position of the magnet.

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16. (Amended) A non-contact rotational position sensor according to Claim 9, wherein the magnetic flux density in at least the magnetic plates is not higher than 0.5 T.

17. (New) A non-contact rotational position sensor according to Claim 9, wherein said magnetic sensitive device is a Hall device or a Hall IC.

18. (Amended) A non-contact rotational position sensor according to Claim 9, wherein said magnetic plate and a member for fixing said magnetic plate are comprise a one-piece resin-molded unit.

Cancel Claim 19

20. (Amended) A non-contact rotational position sensor according to Claim 9, wherein at least one hole is formed in said magnetic plate near said protruded magnetic substance portion.

21. (Amended) A non-contact rotational position sensor comprising:
a rotating axis;
an annular or semi-annular magnet fixed to said rotating axis;
magnetic substance assemblies arranged in opposing relation to sandwich said magnet therebetween with a spacing greater than a thickness of said magnet left between said magnetic substance assemblies in an axial direction of said rotating axis, such that a uniform air gap is defined between said magnet and a surface of each of said magnetic substance assemblies confronting said magnet;

a pair of small air gaps defined between said magnetic substance assemblies and being smaller than said uniform air gap; and

a magnetic sensitive device disposed in said small air gap, the [at least one pair of] magnetic substance assemblies comprising upper and lower magnetic plates in which the upper magnetic plate is comprised of a first upper magnetic plate and a second upper magnetic plate, the lower magnetic plate is comprised of a first lower magnetic plate and a second lower magnetic plate, the magnet is comprised of two magnets with the first of the being magnetized in one direction and the second of the magnets being magnetized in a direction opposite to the one direction; a first area in which a magnetic field of the first magnet has the one direction and a first area in which a magnetic field of the second magnet has the opposite direction being positioned between first upper magnetic plate and the first lower magnetic plate; and a second area in which the magnetic field of the first magnet has the one direction and a second area in which the magnetic field of the second magnet has the opposite direction being positioned between second upper magnetic plate and the second lower magnetic plate; whereby the first upper magnetic plate and the first lower magnetic plate thus form a linear magnetic circuit between the magnet and the protruded magnetic substance portion independent of the rotational position of the magnet, and the second upper magnetic plate and the second lower magnetic plate thus form a linear magnetic circuit between said magnet and a protruded magnetic substance portion independent of the rotational position of the magnet.

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23. (Amended) A non-contact rotational position sensor according to Claim 21, wherein said pair of magnetic plates are each rectangular in shape.

24. (Amended) A non-contact rotational position sensor according to Claim 21,
wherein;

at least one of said pair of magnetic plates has a split air gap formed along an
imaginary plane passing an axial center line of said rotating axis, said air gap splitting said
magnetic plate into two parts; and

said pair of small air gaps are formed in symmetrical positions with respect to said
split air gap situated therebetween.

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